The plant is of such unusual interest that his results deserve rather full statement.

The maximum age attained by individual plants is probably much greater than a century; and plants growing in contact readily form natural grafts, into the composition of which several individuals may enter. Pollination is effected, partly, at least, by insects. The development of the spores and of the embryo proceed with remarkable rapidity for a gymnosperm. Microsporogenesis resembles that described for Ephedra and Gnetum; and at dehiscence three nuclei are found in the pollen grain, one of which, probably prothallial, disappears before shedding. The single megaspore mother cell forms the usual linear tetrad, the innermost spore functioning. In the germination of the megaspore there is abundant free nuclear division, and a strong growth of the sac towards the micropyle and into the chalazal region. The formation of cell walls occurs throughout the embryo sac, the cells thus formed often being multinucleate. Each peripheral cell towards the micropyle, containing two to five nuclei, produces a tubular outgrowth which penetrates the nucellar cap like a pollen tube. As this tube advances the nuclei pass into it, and the distance traversed before pollination occurs is considerable. These free nuclei are sexual, and hence the condition is that of Gnetum. These tube-forming cells have been taken for archegonium initials, but it is evident that the tube is only an extension of the prothallium containing free sexual nuclei; and hence PEARSON rightly calls it the "prothallial tube." This is a most satisfactory disposition of a troublesome structure; and we find that in the act of fertilization Welwitschia is even more specialized than is Gnetum.

It is to be regretted that the first stages of embryo-formation were not shown by the material, for the current statements in reference to it are as obscure and meaningless as have been those in reference to the so-called "archegonium initials."—J. M. C.

**Mendelism in agriculture.**—No other single scientific proposition has elicited so much interest from agriculturists and breeders as MENDEL'S laws of inheritance, and the number of more or less satisfactory popular presentations has become large. Several of these have already been noted. TSCHERMAK[26] adds another in a lecture before the German Agricultural Society, in which particular attention is given to the results in the breeding of cereals. Besides the general explanation of Mendelism, he gives tables showing what characters of the several cereals have been found dominant and what recessive. These tables include sixteen pairs of characters in wheat, five in rye, thirteen in barley, and three in oats. A short section is devoted to the technic of crossing, and another to the importance of establishing stations and properly equipping them for carrying on such investigations.

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[26] TSCHERMAK, E., Die Kreuzung im Dienste der Pflanzenzüchtung. Jahrb. Deutsche Landw. Gesells. **20**:325–338. 1905.

HALSTED[27] has also issued a bulletin which gives a good general discussion of Mendelism as exemplified by cooperative experiments in the breeding of corn. In 1904 "Black Mexican" sweet corn was crossed with nearly a full list of the commercial varieties of sweet corn, and the hybrid ears thus obtained were sent to a number of volunteer observers in different parts of the state, who returned samples and notes which are incorporated into this bulletin. The presentation is simple and easily understood, but several unfortunate typographical errors are likely to prove confusing, as when on p. 15 in the table showing what may be expected in the second generation of a cross between large grained flint black, and small grained sweet white, the fourth category (large sweet white) is weighted with the value 9 instead of 3; and again, when on p. 21, line 7, "white" is used for "dark."

An improper emphasis is laid upon the difficulty of freeing the dominant form from traces of the recessive. Thus, he says that after nineteen generations of selection there will still be one recessive grain in each four hundred, adding that "this underlying rule," which appears to hold more or less closely, helps to indicate how difficult it is to eradicate entirely any characteristic that has been introduced in breeding." He seems to have overlooked the importance of VILMORIN'S principle of isolation, by which it requires only one more generation to obtain pure extracted dominants than extracted recessives, so that after the *third* generation he need never have another recessive grain appear.—GEORGE H. SHULL.

**Inheritance in Shirley poppies.**—PEARSON and his associates, with the aid of a number of volunteer observers, have presented a second paper[28] on inheritance in the Shirley poppy. Some of the questions that were left open in the earlier report[29] have been settled. Thus, it was assumed that Shirley poppies both self- and cross-fertilize, and the discussions were based upon that assumption. It is now found that when flowers are enclosed in bags of bolting-cloth or oiled paper, almost no fertilization takes place. Fifty bagged flowers produced seeds in only four, and these gave rise to nine plants. The conclusion is reached, therefore, that seeds taken from unprotected capsules are essentially the result of cross-fertilization; and the correlation of offspring with each other and with their antecedents should be the same as in other populations in which self-fertilization does not occur, as in animals and man. Although the correlation found is somewhat lower than the average for animals, a number of modifying factors are pointed out which would tend to lessen the correla-

[27] HALSTED, B. D., Breeding sweet corn—cooperative tests. N. J. Agr. Exp. Sta. Bull. 192. pp. 30. *pls. 4, figs. 8.* March 1906.

[28] PEARSON, K., et al., Cooperative investigations in plants. III. On inheritance n the Shirley poppy. Second Memoir. Biometrika 4:394–426. 1 *pl.* (colored). 1906.

[29] PEARSON, K., et al., Cooperative investigation in plants. I. On inheritance n the Shirley poppy. Biometrika 2:56–100. 1902.